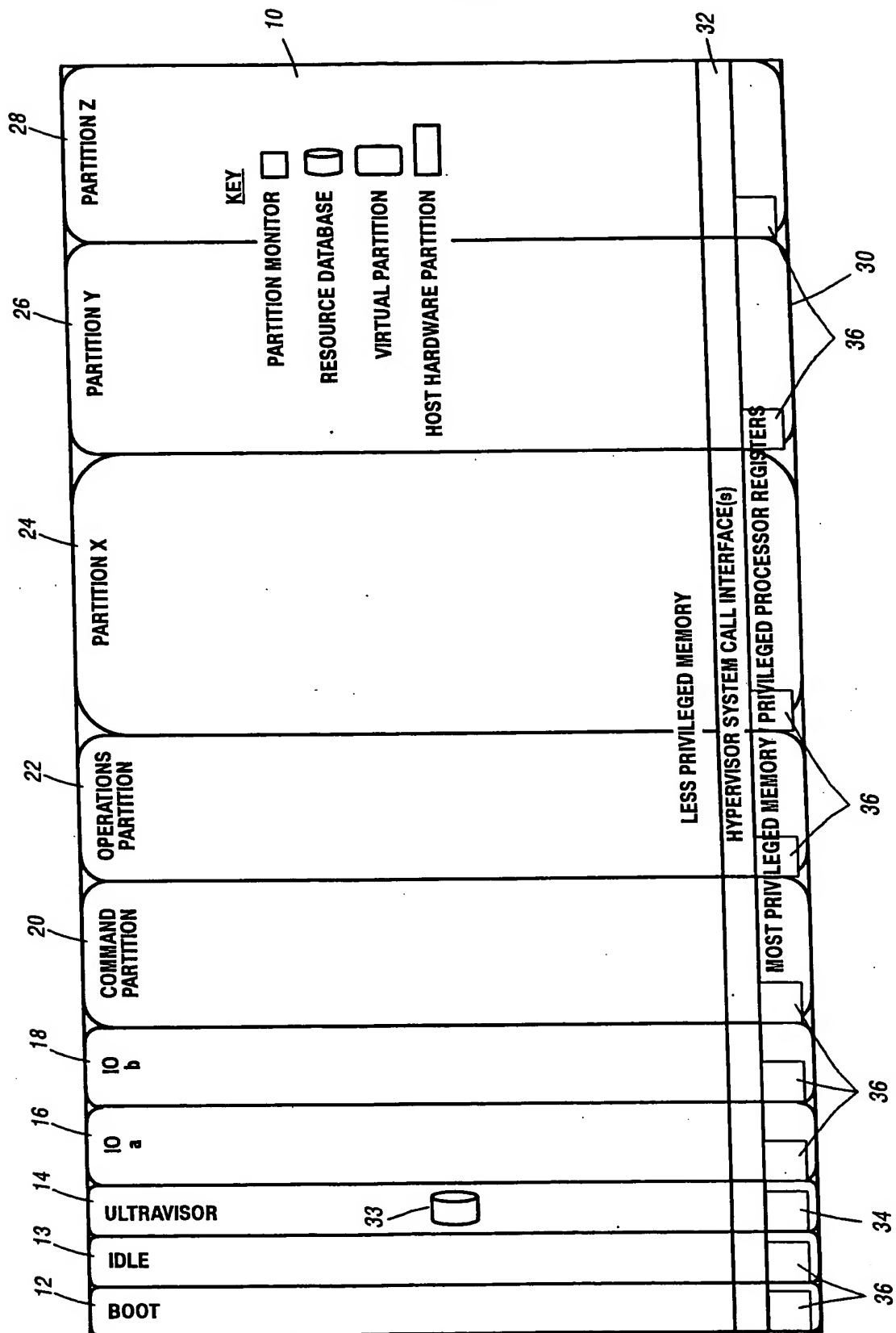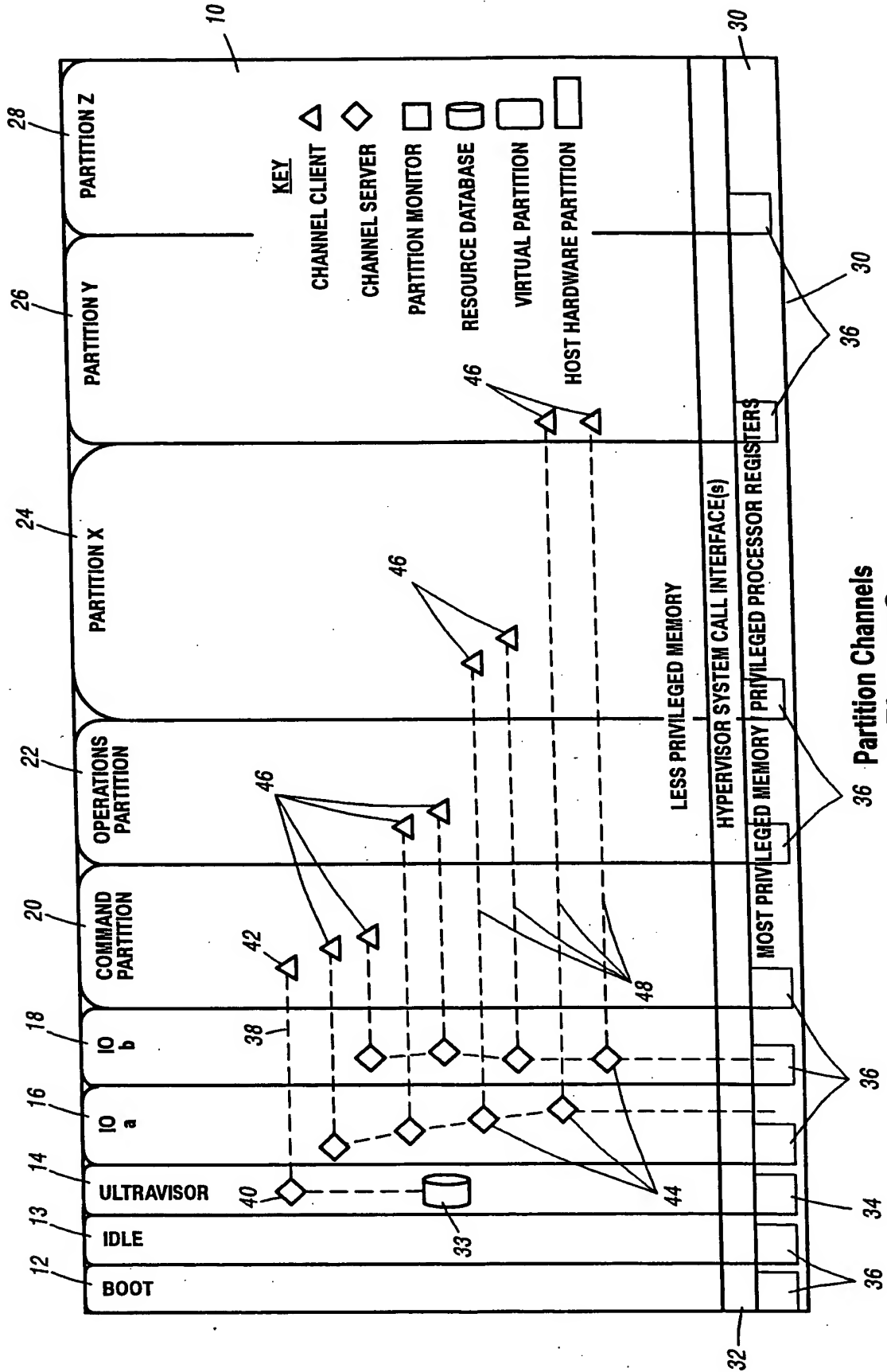**Partitioned Host System**

Figure 1
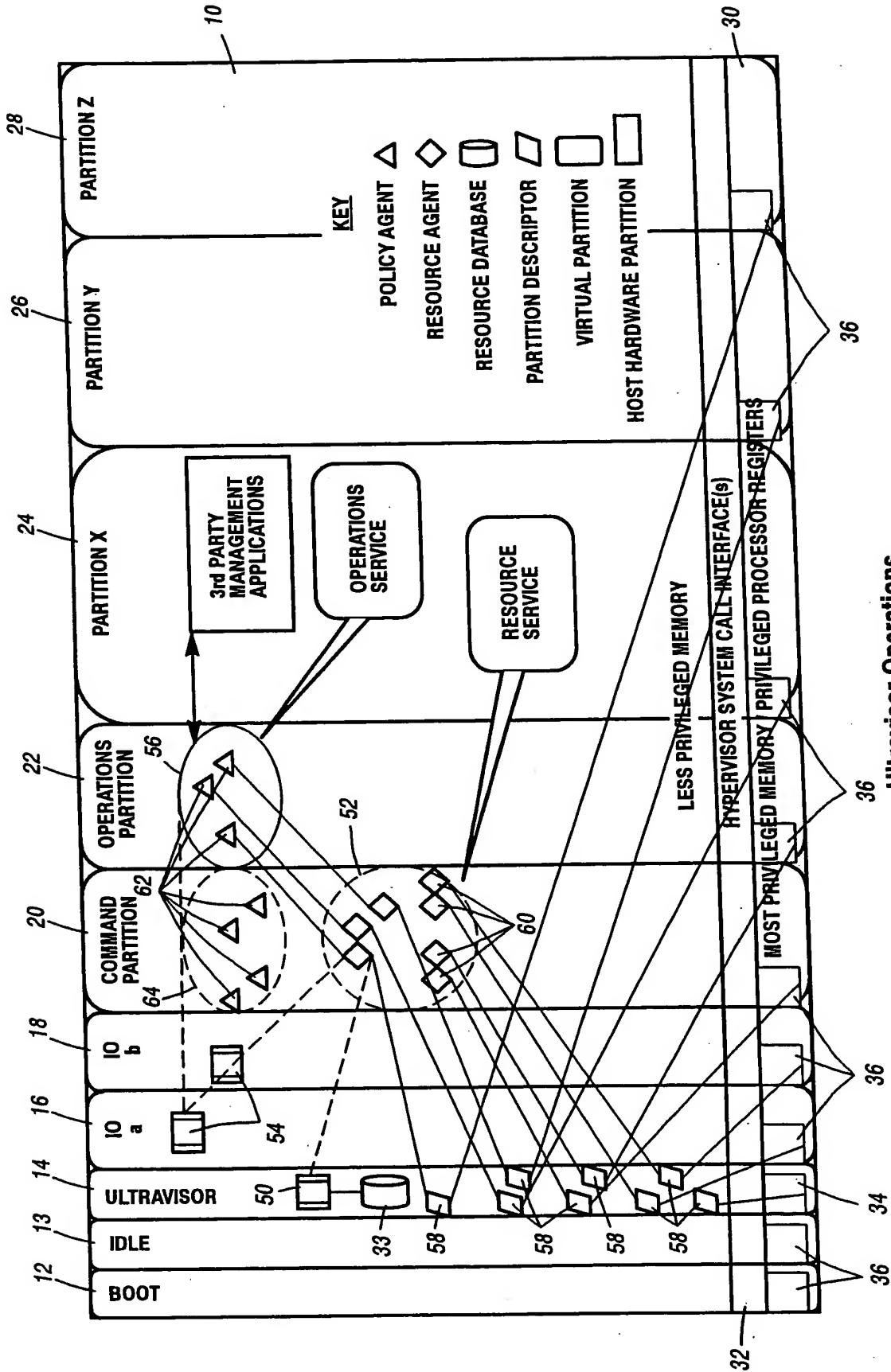
Partition Monitors

Figure 2

Partition Channels

Figure 3

Ultravisor Operations

Figure 4

KEY

△ POLICY AGENT
◇ RESOURCE AGENT
⬭ RESOURCE DATABASE
▱ PARTITION DESCRIPTOR
▭ VIRTUAL PARTITION
▭ HOST HARDWARE PARTITION

PARTITION Z 28

PARTITION Y 26

PARTITION X 24

3rd PARTY MANAGEMENT APPLICATIONS

OPERATIONS SERVICE

RESOURCE SERVICE

OPERATIONS PARTITION 22

COMMAND PARTITION 20

IO b 18

IO a 16

ULTRAVISOR 14

IDLE 13

BOOT 12

LESS PRIVILEGED MEMORY

HYPERVISOR SYSTEM CALL INTERFACE(s)

PRIVILEGED PROCESSOR REGISTERS

MOST PRIVILEGED MEMORY

10

30

36

32

34

33

50

52

54

56

58

60

62

64

OVERLAPPED PROCESSOR THROTTLING – DEFAULT 4 BIT DUTY WIDTH (1/16 = 6.25%)

50%
WIDTH 8
OFFSET 0 — 8

25%
WIDTH 4
OFFSET 8 — 4

25%
WIDTH 4
OFFSET 12 — 4
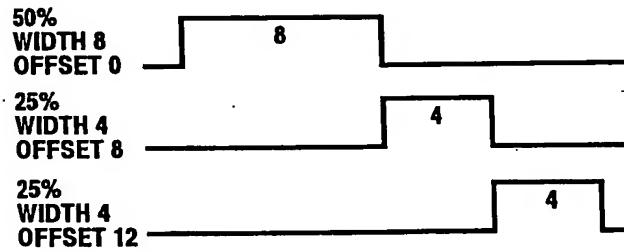
Processor Sharing

Figure 5

TIME
QUANTUM

IOa

COMMAND

GUEST

GUEST

GUEST

OPERATIONS

GUEST

GUEST

GUEST

GUEST

IOb

GUEST

GUEST

GUEST

0   4   8   12   15
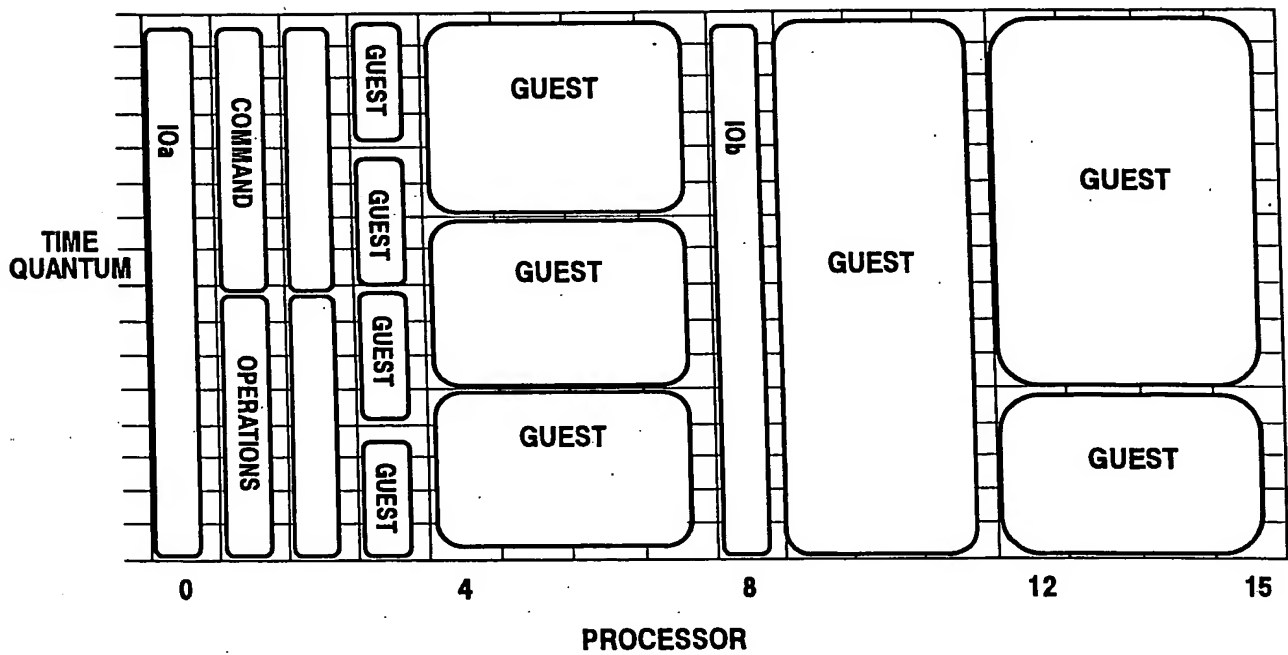
PROCESSOR

Processor Schedule

Figure 6

$(2^{10})^n$	SI Prefix	SI Name	Page Table	Pageantry	IA32/EM32T
1	K	kilo	PKM	PKE	PT/PTE
2	M	mega	PMM	PME	PD/PDE
3	G	giga	PGM	PGE	PDP
4	T	tera	PTM	PTE	PML4
5	P	peta	PPM	PPE	
6	E	Exa	PEM	PEE	
7	Z	zetta	PZM	PZE	
8	Y	yotta	PYM	PYE	

SI Prefixes for Page Table Hierarchy

Figure 7

Function GetMemoryOwner [T : 0..1023, G:0..1023, M:0..1023, K:0..1023] of Int32

Memory Index Ref	1		GB	MB	KB

Partition number (32 bits)	O	S	Node (GB)	MB	KB

PGM: T=0 G=x

```
0: [-, 0,1,1]
1: [0,1,25]
2: [0,1,20]
. .
14: [0,1,20]
15: [-,0,1,16]
16: [0,1,19]
. . .
1023 [0,1,19]
```
Mem[0,1,0]

PMM: T=0 G=0 M=x

```
0: [-, 0,1,22]
1: [-,0,1,18]
2: [0,1,24]
3: [0,1,20]
. . .
767: [0,1,20]
768: [0,1,26]
. . .
1023: [0,1,26]
```
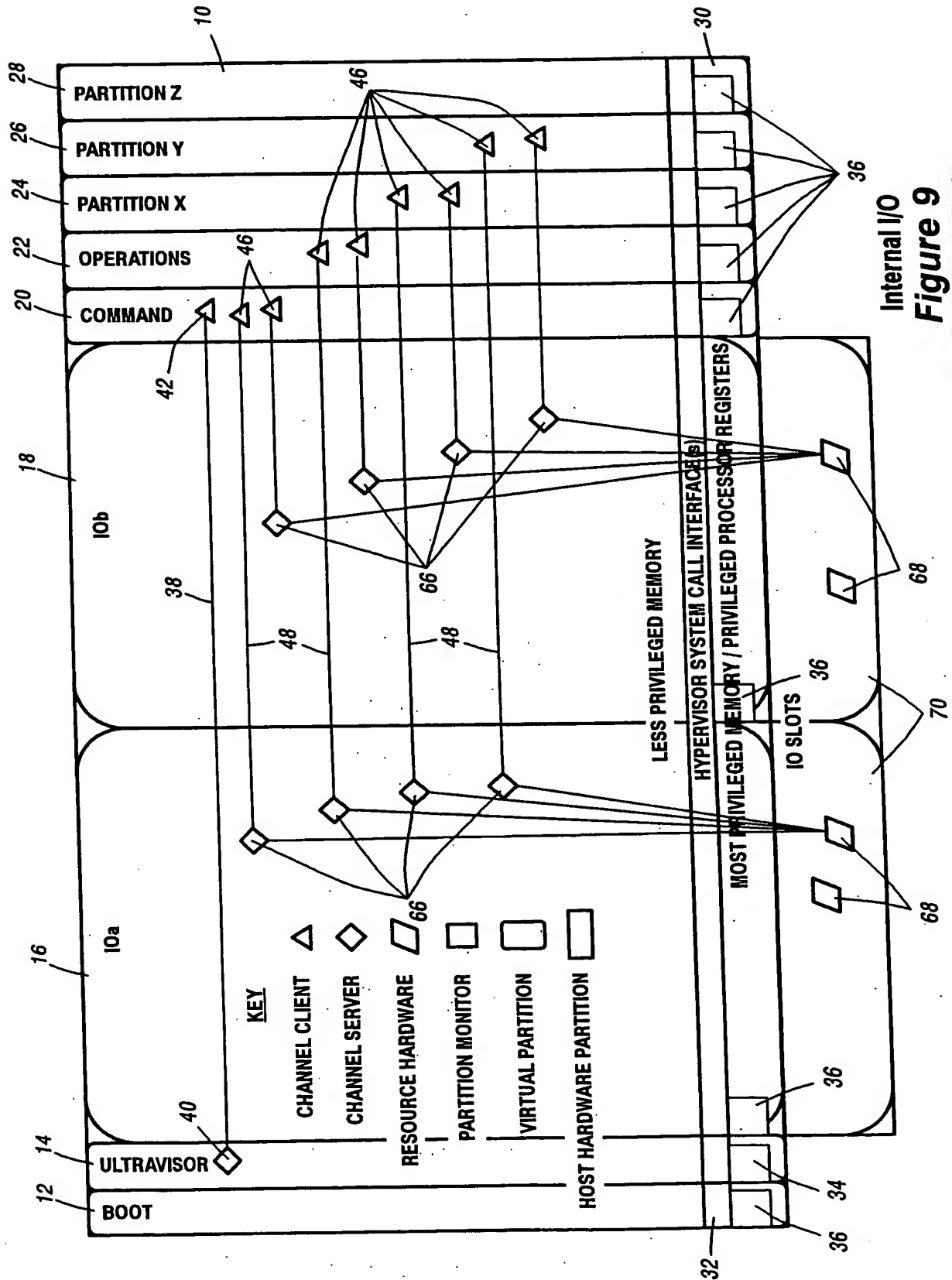Mem[0,1,1]

PMM: T=0 G=15 M=x

```
0: [0,1,20]
. . .
1023: [0,1,20]

–redundant
```
Mem[0,1,16]

PKM: G=0 M=1 K=x

```
0: [0,1,24]
1: [0,1,24]
. . .
23: [0,1,24]
24: [0,1,24]
25: [0,1,25]
26: [0,1,26]
27: [0,1,20]
1023: [0,1,20]
```
Mem[0,1,18]

Ultravisor Index

```
Type: Index
MapHigh [0,0,0]
MapLow [0,1,0]
MapOrder 3
Index [0,1,23]
Hyper [0,1,24]
Avail: [0,1,20]
```
Mem[0,1,23]

Ultravisor Partition

```
Type: Partition
Id: Ultra
Me: [0,1,24]
3.9MB
[0,2x]
```
Mem[0,1,24]

Partition X

```
Type: Partition
Id: User X
Me: [0,1,25]
4GB [1,x,x]
(4–7 GB)
```
Mem[0,1,25]

Partition Y

```
Type: Partition
Id: User Y
Me: [0,1,26]
1GB
[0,768,x]–
[0,1023x]
```
Mem[0,1,26]

Partition Missing

```
Type: Partition
Id: Missing
Me: [0,1,19]
3.9375TB
(64GB–4TB]
```
Mem[0,1,19]

Partition Available

```
Type: Partition
Id: Available
Me: [0,1,20]
58.9GB
(8.64GB)
```
Mem[0,1,20]

Partition Idle

```
Type: Partition
Id: Idle
Me: [0,1,21]
64KB
<not shown>
```
Mem[0,1,21]

Partition Boot

```
Type: Partition
Id: Boot
Me: [0,1,22]
4MB
[0,0,0]–
[0,0,1023]
```
Mem[0,1,22]
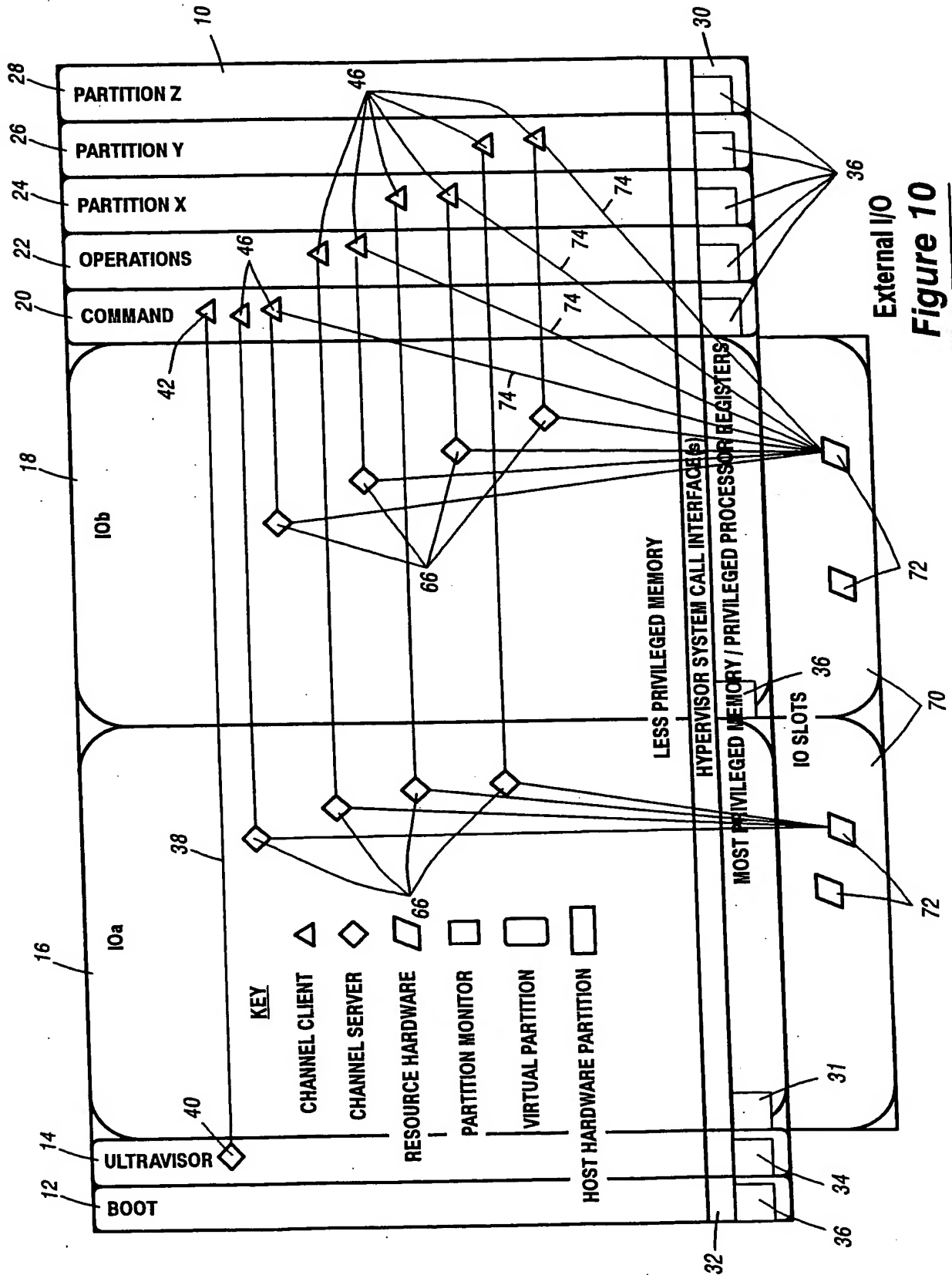
Where Mem[G,M,K] := ((G * 2**10+M) * 2 **10 + K) * 2**10*2**2

Partition Memory Map

Figure 8

Internal I/O
Figure 9

External I/O
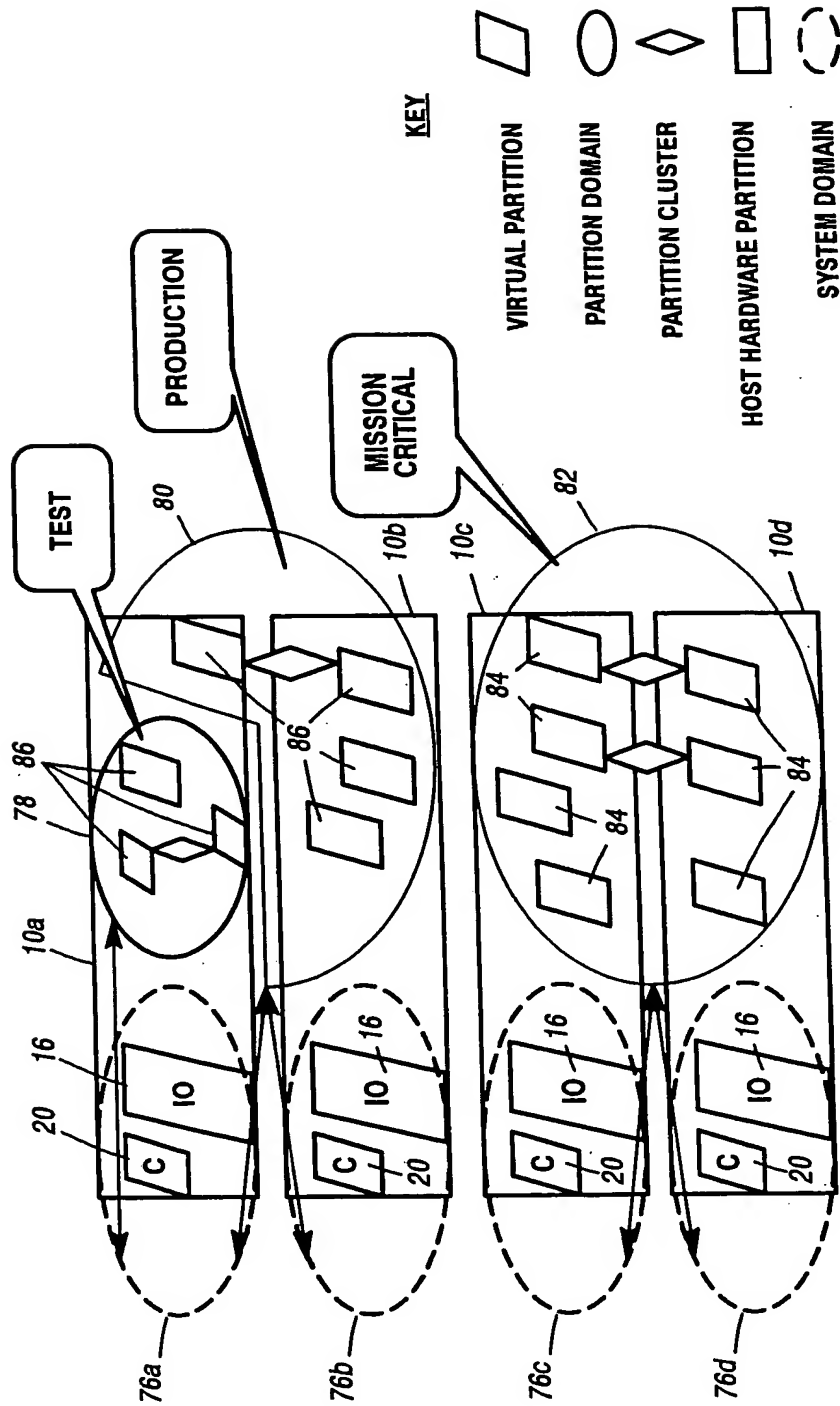
Figure 10

Ultravisor Domains

Figure 11

KEY

POLICY AGENT

POLICY DOMAIN

SYSTEM DOMAIN

RESOURCE AGENT

RESOURCE DOMAIN

VIRTUAL PARTITION

HOST HARDWARE PARTITION

SERVICE CONNECTION
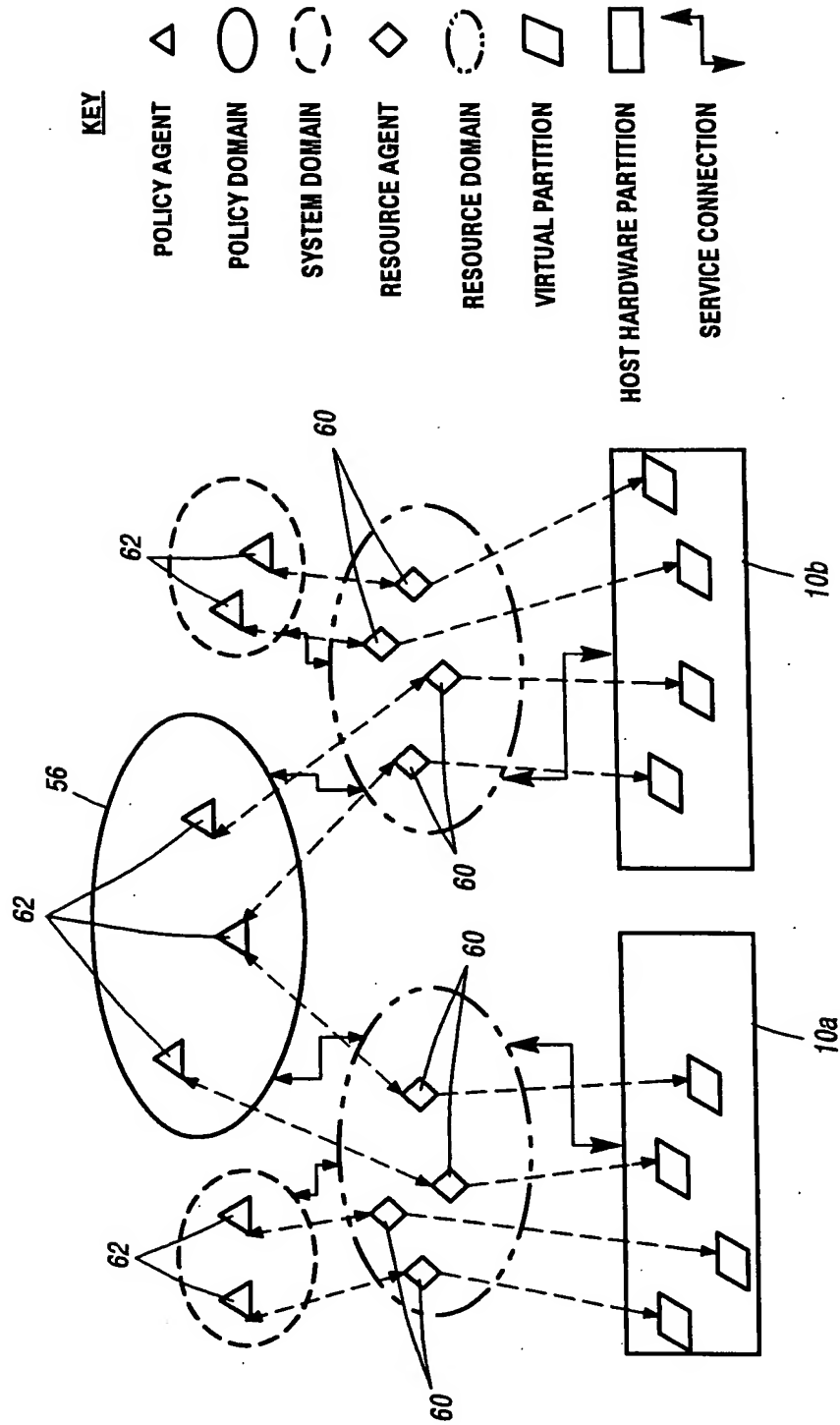
Ultravisor Partition Agents

Figure 12
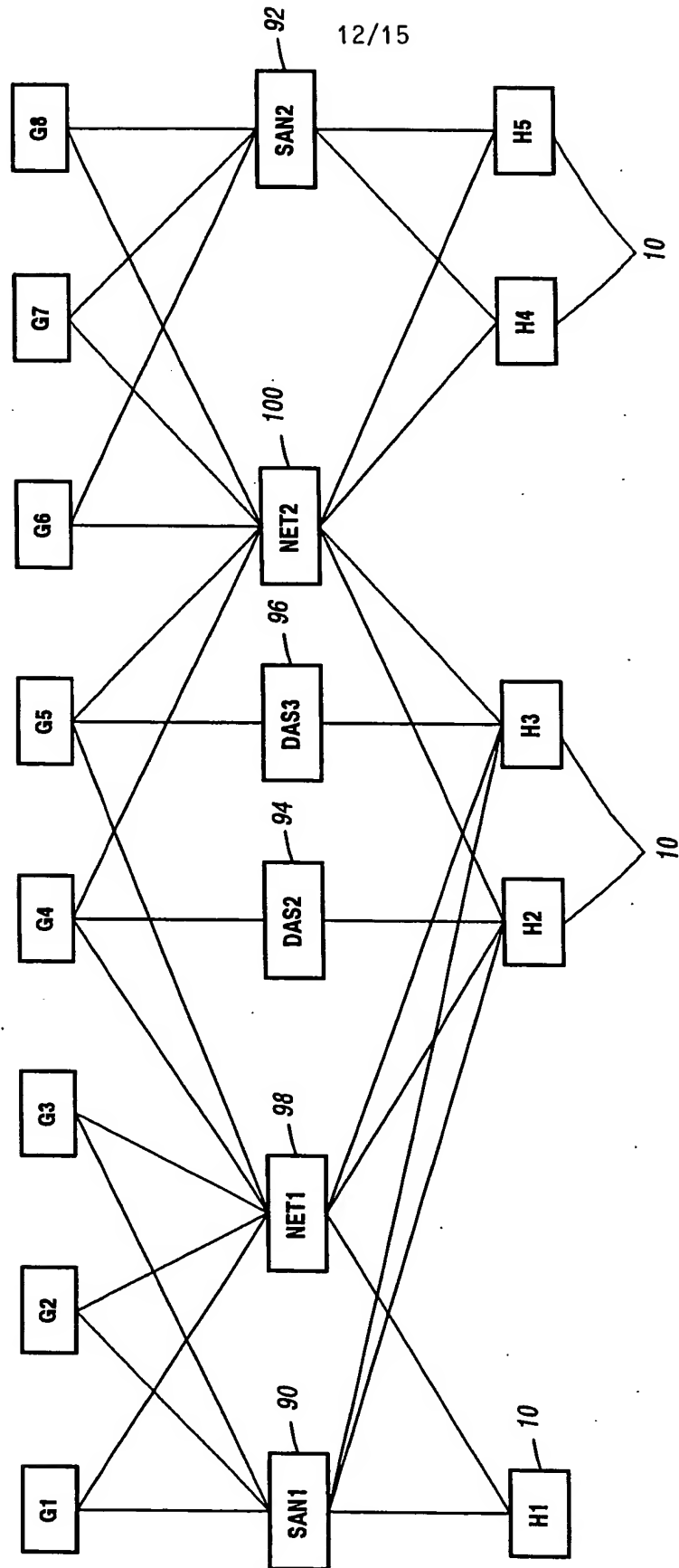
Virtual Data Center Zones

Figure 13
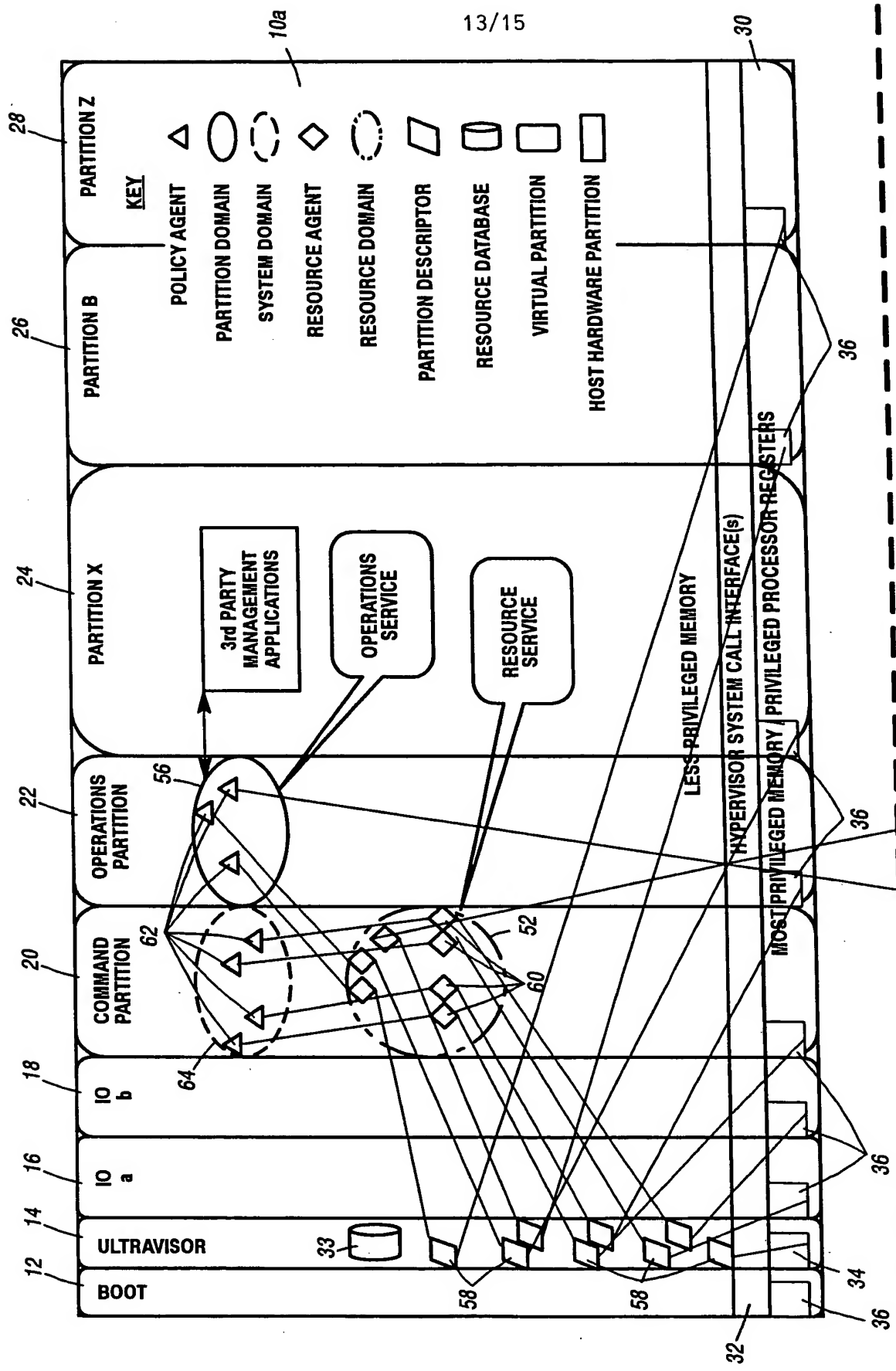
Data Center / Multiple Hosts

Figure 14A

Figure 14

Fig. 14A
Fig. 14B

KEY

△	POLICY AGENT
○	PARTITION DOMAIN
◯ (dashed)	SYSTEM DOMAIN
◇	RESOURCE AGENT
◯ (dashed)	RESOURCE DOMAIN
▱	PARTITION DESCRIPTOR
⬮	RESOURCE DATABASE
▭	VIRTUAL PARTITION
▯	HOST HARDWARE PARTITION

PARTITION Z

PARTITION B

PARTITION X

3rd PARTY MANAGEMENT APPLICATIONS

OPERATIONS SERVICE

RESOURCE SERVICE

OPERATIONS PARTITION

COMMAND PARTITION

IO b

IO a

ULTRAVISOR

BOOT

LESS PRIVILEGED MEMORY

HYPERVISOR SYSTEM CALL INTERFACE(s)

MOST PRIVILEGED MEMORY / PRIVILEGED PROCESSOR REGISTERS

10a

28

26

24

22

20

18

16

14

12

30

32

33

34

36

52

56

58

60

62

64

PARTITION C — 28

PARTITION Y — 26

10b

KEY

△ POLICY AGENT

◯ PARTITION DOMAIN

◯ (dashed) SYSTEM DOMAIN

◇ RESOURCE AGENT

◯ (dashed) RESOURCE DOMAIN

▱ PARTITION DESCRIPTOR

⬠ RESOURCE DATABASE

▭ VIRTUAL PARTITION

▭ HOST HARDWARE PARTITION

PARTITION A — 24

3rd PARTY MANAGEMENT APPLICATIONS

OPERATIONS SERVICE

RESOURCE SERVICE

56

OPERATIONS PARTITION — 22

COMMAND PARTITION — 20

62

64

52

60

IO b — 18

IO a — 16

ULTRAVISOR — 14

33

BOOT — 12

58

58

34

LESS-PRIVILEGED MEMORY

HYPERVISOR SYSTEM CALL INTERFACE(s)

MOST PRIVILEGED MEMORY / PRIVILEGED PROCESSOR REGISTERS

30

36

36

36

32

36

Data Center / Multiple Hosts

Figure 14B

KEY

△ CHANNEL CLIENT
◇ CHANNEL SERVER
▢ PARTITION MONITOR
⛁ RESOURCE DATABASE
▢ VIRTUAL PARTITION
▢ HOST HARDWARE PARTITION

LESS PRIVILEGED MEMORY

HYPERVISOR SYSTEM CALL INTERFACE(s)

MOST PRIVILEGED MEMORY/PRIVILEGED PROCESSOR REGISTERS

Multiple Ultravisor Resource Partitions

Figure 15